

R E M A R K S

This is in response to the Office Action of June 22, 2009. A grammatical amendment is made to claim 7. This amendment is merely for the purpose of simplifying the language, and in no way affects the scope of claim 7. No new matter is introduced by this Amendment. Claims 1-20 remain pending in the application.

Claims 1-6, 12, 14, and 19 were provisionally rejected on the ground of obviousness-type double patenting over claims 1-3, 8-10, 12-15, and 17 of application Serial No. 10/585,055. Office Action, pages 2-3. The reference application is later-filed with respect to the present application. It is respectfully requested, therefore, that the issue of double patenting be resolved in application Serial No. 10/585,055 rather than in the present application.

Claims 1-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US 4,000,032 (Bergstrom) in view of WO 03/029329 (Swatloski) and PCT/AU01/00100 or its equivalent, US 2003/0157268 (Gutowski). Office Action, pages 4-6. The rejection is respectfully traversed.

BERGSTROM provides a process for freeing cellulose fibers from lignocellulosic material, which comprises subjecting particulate lignocellulosic material to microwave irradiation at such an intensity that the water present in the lignocellulosic material is vaporised, and the lignocellulosic structure is disintegrated, thereby freeing the cellulose fibers. The Bergstrom process produces a pulp comparable to mechanical pulp but which has an improved strength (column 6, lines 9-12). Thus, Bergstrom provides an alternative process for producing mechanical pulp. According to Bergstrom (column 3, lines 38-51), the lignocellulosic material should have a high water content of at least about 10% up to about 90%, preferably from about 25% to 90% by weight. The high water content is necessary for the Bergstrom process, because the water present in the lignocellulosic material rapidly absorbs the microwave radiation, thereby

becoming heated to form steam which disrupts or disintegrates or even explosively destroys the structure (column 5, lines 1-10). The Examiner calls this disruption “depolymerization,” which terminology does not appear in the Bergstrom disclosure. The hot steam softens the lignin, and this in turn weakens the bond strength. Due to that weakness, the fibers are easier to separate from the structure without shortening the fibers (column 5, lines 10-21). However, the Bergstrom treatment does not have any chemical effect on the lignin which binds the fibers to the lignocellulosic structure. Therefore in Bergstrom the lignin cannot be separated from the cellulose, hemicellulose, and other components of the lignocellulose.

Significant distinguishing features from the present invention are that Bergstrom does not contain any dissolving step of lignocellulosic material, there are no ionic liquids involved in the Bergstrom technology, and the disruption method requires excessive contents of water in order to facilitate the freeing of cellulose fibers. Bergstrom does not suggest the possibility to dissolve the lignocellulosic material, either into ionic liquids or any other media. On the contrary, Bergstrom teaches how to avoid any unnecessary dissolution of lignocellulosic material in order to free cellulose fibers from lignocellulosic material in high yield. This is achieved with high water contents of lignocellulosic material and microwave-assisted disruption of said material, which is contrary to the approach of the present invention, wherein the dissolution of lignocellulosic material must be carried out in the substantial absence of water.

In conclusion, the main features distinguishing the claimed invention from Bergstrom are: i) the lignocellulosic material is completely dissolved to form a homogenous solution; ii) the solvent is free from water or essentially free from water; dissolution is not even successful in a water solution; iii) the end product of the process is a solution that contains all the components of the lignocellulosic material dissolved in the ionic solvent (not a softened lignocellulosic material wherein the lignocellulosic material is in the form of an undissolved aqueous slurry as is disclosed by Bergstrom); and iv) as the components of the lignocellulosic material are dissolved in the ionic solvent and the obtained solution is homogenous (not a slurry) the components of the lignocellulosic material can be separated from each other in said solution, for example by precipitating the cellulose fibers by the addition of an non-solvent, such as an alcohol.

Correspondingly, lignin can be separated from the solution before the precipitation of the cellulose fibers.

SWATLOSKI is discussed on page 4 in the present application. Swatloski provides a method for dissolving pure cellulose in an ionic liquid preferably assisted by microwave irradiation. Due to the different chemical nature of cellulose and lignocellulosic material which in addition to cellulose contains lignin, hemicellulose as well as various extractives, the man skilled in the art would not expect there would be any such solvents that could dissolve all said components simultaneously. Cellulose is usually obtained by digesting lignocellulosic material in an alkaline solution to separate lignin, extractives and part of the hemicellulose from the undissolved cellulose. Contrary to the present invention, Swatloski does not teach or suggest that i) lignocellulosic material which in addition to cellulose contains lignin, hemicellulose as well as various extractives can be dissolved in ionic liquids, and that ii) lignin can be dissolved in ionic liquids. As lignin differs totally from cellulose in respect of the chemical nature, it is not obvious to the person of ordinary skill in the art that lignin-containing lignocellulosic materials, especially wood can be dissolved in ionic liquids. Additionally, it is not obvious to the person of ordinary skill in the art that the lignin-cellulose bonds of a lignocellulosic material could be opened by dissolving the same in ionic liquids. In conclusion, Swatloski does not contain any teaching or motivation for dissolving lignocellulosic materials in ionic liquids.

GUTOWSKI is cited only for its paragraph [0055]<sup>1</sup>, wherein it is indicated that cellulose never occurs in pure form, and instead that it is usually embedded in lignocellulose. The relevance of this document is not clear. It appears that the PTO is attempting by this document to create a link between Bergstrom (subjecting lignocellulosic material to irradiation to disrupt and destroy the natural structure of the lignocellulosic material, thereby freeing the cellulose fibers) and Swatloski (dissolution of cellulose in an ionic liquid). It should however, be noted that the cited paragraph of Gutowski relates to Natural Polymeric Material (see paragraph

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<sup>1</sup> In US 2003/0157268.

[0040]). Gutowski simply acknowledges the well-known fact that cellulose in natural materials never occurs in pure form. As explained in Applicants' specification on page 4, last paragraph, the cellulose to be dissolved by Swatloski is cellulose in a highly pure form. Such a material is typically obtained by digesting lignocellulosic materials in alkaline solutions. In contrast, the "lignocellulosic material" of the present invention is defined as "a natural material containing cellulose and lignin that has not been subjected to a pulping or defibering process." See the specification, page 10, third-to-last paragraph). Thus, chemical and mechanical pulps and the like are not included in this definition. One of the preferred materials in the present invention is native wood (as opposed to wood pulp).

Applicants respectfully submit that the Bergstrom and Swatloski and Gutowski disclosures, even as combined by the Examiner, fail to teach or suggest "A method for dissolving lignocellulosic material comprising mixing the lignocellulosic material with an *ionic liquid solvent* under microwave irradiation and/or under pressure in the substantial *absence of water* to completely *dissolve the lignocellulosic material*." Withdrawal of the rejection of record is in order and is earnestly solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Richard Gallagher, Reg. No. 28,781, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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